



**IUID**

Item Unique  
Identification

## **Concurrent RFID/UID Implementation at Naval Surface Warfare Center, Crane Division**

**A Naval Postgraduate School Master of Business  
Administration Thesis Study in Item Unique  
Identification and Radio Frequency Identification**





As part of their Master of Business Administration thesis at Naval Postgraduate School (NPS) in Monterey, California, United States Navy Lieutenant Commanders Travis Colleran, Ryan Lookabill, and Ernan Obellos developed an implementation plan to apply Unique Identification (UID) and Radio Frequency Identification (RFID) concurrently at Naval Surface Warfare Center, Crane Division (NSWC Crane) in Crane, Indiana.

## Background

The three NPS LCDRs used the developments put into place at the Space and Naval Warfare Systems Command (SPAWAR) Extremely High Frequency (EHF) Satellite Communications (SATCOM) Branch in San Diego as a baseline for the implementation at NSWC Crane. In addition to the development of a concurrent RFID/UID implementation plan for NSWC Crane's primary warehouse facility, the students conducted a Knowledge Value-Added (KVA) analysis of the current and future investment status of NSWC Crane's implementation.

The thesis's final developed plan specifically addressed implementation at NSWC Crane's main warehouse facility and detailed a step-by-step process to achieve operational approval. The plan provided who, what, and when for completing the concurrent implementation; the why required further analysis.

To demonstrate the why of the implementation plan, the authors chose KVA analysis as a means to demonstrate a satisfactory return for this Information Technology (IT) investment. That analysis proved that the concurrent implementation of RFID/UID significantly contributes to the inventory management process of NSWC Crane and meets the DoD's requirement as a worthwhile IT investment.

## SPAWAR

SPAWAR Code 4122 is a Navy leader in RFID/UID implementation. Led by Mr. Y.Y. Wong and Northrop Grumman Corporation's Mr. Barry Jones, the RFID/UID system developed and utilized by Code 4122 provided the baseline guidance for NSWC Crane's concurrent RFID/UID implementation.

Inventory Cost Differences Per 100 Parts					
Between using MRI with Handheld and human data entry					
Method	# of Parts	Labor\$/Hr	Labor\$/Min	# of Minutes	\$/100 Parts
Manually	100	\$50	\$0.83	150	\$124.50
Handheld	100	\$50	\$0.83	5	\$4.15
SAVINGS PER 100 PARTS					\$120.35

Table A, Inventory Cost Differences Per 100 Parts.

The implementation of the concurrent RFID and UID at Code 4122 was initiated in response to the DoD mandates, the process requirements within SPAWAR, and to improve the efficiency of its current processes.

The stated goals for the use of RFID/UID by Code 4122 are:

- ◆ Maximize efficiencies of life-cycle asset management with integration of RFID/UID throughout DoD.
- ◆ Leverage technology to improve the ability to get the customer the right materiel, at the right time, and in the right condition.
- ◆ Recognize the technology is critical to the End-to-End War fighter Support initiative.

Prior to implementation, Code 4122 faced difficulties that could be considered typical of warehouse-based operations. The manual processes that were involved in the areas of inventorying, shipping, receiving, and maintenance were prone to human error and time-consuming inefficiencies.

The implementation of RFID and UID at Code 4122 resulted in significant cost avoidance. The inventory cost difference yielded \$120.35 per 100 parts (see Table A). This difference is attributable to the reduction in the amount of time required for each process.

Table B further shows that the reductions would yield significant total cost avoidance over a five-year period. These cost avoidances are a direct result of a reduction in labor. This data shows the efficiencies gained in the processes that allow for resources, both time and money, to be reallocated to other areas.

Without RFID and IUID:						
Yearly Total Costs/Hours for Five Years						
	Year 1	Year 2	Year 3	Year 4	Year 5	Total
Cost	\$109,833.33	\$109,833.33	\$109,833.33	\$109,833.33	\$109,833.33	\$549,166.67
Hours	2622	2622	2622	2622	2622	
With RFID and IUID:						
Yearly Total Costs/Hours for Five Years						
	Year 1	Year 2	Year 3	Year 4	Year 5	Total
Costs	\$38,565.73	\$23,035.73	\$23,035.73	\$23,035.73	\$23,035.73	\$130,708.67
Hours	450	450	450	450	450	
Avoidance:						
Total Cost Avoidance						
	Year 1	Year 2	Year 3	Year 4	Year 5	Total
Costs	\$71,267.60	\$86,797.60	\$86,797.60	\$86,797.60	\$86,797.60	\$418,458.00
Hours	2,172	2,172	2,172	2,172	2,172	

Table B, Naval Extremely High Frequency Satellite Program UID/RFID Cost Analysis.

## **NSWC Crane**

### *Description*

The NSWC Crane RFID/UID concurrent implementation system that will result from this project is NSWC Crane Inventory Management System (NCIMS) Wireless Complex. NCIMS will include four separate staging areas that receive and process material. All of the leading edge RFID portals, the wireless, handheld RFID and UID scanners, the printers, and the special software associated with these devices will be utilized, evaluated, and accredited. The devices will use a web-based Oracle application to store the data and the latest DoD compliant encryption system in order to protect the transmission of the wireless information.



### *Benefits*

Using data garnered from their site visits to SPAWAR San Diego and NSWC Crane, combined with their KVA analysis of the future value of RFID/UID implementation at NSWC Crane, LCDRs Colleran, Lookabill, and Obellos reached the following conclusions regarding the benefits of concurrent RFID/UID implementation:

- ◆ **Concurrent Implementation – Two for the Price of One**
  - ❖ Observations and analysis determined that concurrent RFID/UID implementation is the right way forward. Concurrent implementation enables NSWC Crane to employ both technologies, saving time, labor, and money, while meeting DoD mandates.
- ◆ **Knowledge Value Added by RFID/UID Implementation**
  - ❖ RFID/UID Implementation dramatically increases the output of the inventory process while also improving the value (accuracy) of that output.
- ◆ **Realizing the Return On Knowledge (ROK) and Return On Investment (ROI)**
  - ❖ RFID/UID technology implementation increases both ROI and ROK ratios as the Market-Comparable Revenue of the inventory sub-process increases significantly compared to the Market-Comparable Process Cost.
- ◆ **Improved Operations Efficiency and Improved Customer Services**
  - ❖ RFID/UID implementation translates to improved efficiency as both the amount and value of the output are enhanced. This leads to less time and resources wasted in rework and recounting.
- ◆ **Improved Local Asset Visibility to Enterprise Wide Visibility**
  - ❖ Improved inventory accuracy drives success in achieving asset visibility. Asset visibility enables supply managers to plan and act in support of war fighters. RFID/UID implementation provides that inventory and asset visibility at the local level for NSWC Crane. This local level asset visibility is the foundation for the Navy and DoD in the quest for Total Asset Visibility.

As demonstrated in the KVA analysis, implementation of the RFID/UID technology increases output in terms of capability to conduct more frequent and accurate inventories enabling improved asset visibility while also dramatically increasing ROK and ROI (see tables on following page). With this gained capability, inventories can be scheduled to optimize validity and achieve “near-real-time total asset visibility” while the amount of labor and time required to conduct inventories is significantly decreased.

## **Contact**

For further information about the thesis or projects described in this document, please contact:

LCDR Travis Colleran  
[travis.colleran@navy.mil](mailto:travis.colleran@navy.mil)  
215-697-6220

LCDR Ryan Lookabill  
[ryan.lookabill@navy.mil](mailto:ryan.lookabill@navy.mil)  
808-473-7576

LCDR Ernan Obellos  
[ernan.obellos@navy.mil](mailto:ernan.obellos@navy.mil)

Jane Zimmerman  
[jane.zimmerman@navy.mil](mailto:jane.zimmerman@navy.mil)  
202-433-2952

Y.Y. Wong  
[wongyy@spawar.navy.mil](mailto:wongyy@spawar.navy.mil)  
619-524-2708

Barry Jones  
[barry.jones@ngc.com](mailto:barry.jones@ngc.com)  
951-813-8110

### “As Is” Inventory Knowledge Value Added Analysis at NSW Crane

Steps	Estimated Learning Time (ALT) (hrs.)	Work Time (hrs.)	Number of Employees	Number of times task completed (Annual)	Sum of task completion (Annual)	Knowledge Amount Embedded in IT (%)	Amount of Knowledge Units (per task)	Total Amount of Knowledge Units (Annual)	% Total Knowledge	Market Comparable Revenue	Total Market Comparable Revenue (Annual)	Process Cost	Total Process Cost (Annual)	ROK
	A	B	C	D	E = A*C*D	F	G = (A*C)+F	H = E*G	I = G/TotalG	J	K = E*J	L = B*J	M = E*L	N = J/L
1) NCIMS-A prints inventory worksheets by location	1	0.25	1	14	14	90.0	91	1274	18%	\$27.53	\$385	\$6.88	\$96.36	400%
*2) Clerk conducts inventory of items	1	8	12	14	168	0.0	12	2016	2%	\$16.50	\$2,772	\$132.00	\$22,176	13%
*3) Clerk records count on worksheet	0.5	8	12	14	84	0.0	6	504	1%	\$8.25	\$693	\$66.00	\$5,544	13%
*4) NCIMS-A manually inputs worksheet data into ILSMIS	1	3	1	14	14	50.0	51	714	10%	\$27.53	\$385	\$82.59	\$1,156	33%
5) NCIMS-SA run exception report of missing items	1	0.15	1	14	14	90.0	91	1274	18%	\$27.53	\$385	\$4.13	\$57.81	667%
6) Clerk conducts recount	0.5	2.5	12	14	84	0.0	6	504	1%	\$8.25	\$693	\$20.63	\$1,733	40%
7) Clerk records recounts on worksheet	0.25	1	12	14	42	0.0	3	126	1%	\$4.13	\$173	\$4.13	\$173	100%
*8) NCIMS-A manually inputs data from recount worksheet	1	1	1	14	14	50.0	51	714	10%	\$27.53	\$385	\$27.53	\$385	100%
9) NCIMS-SA prints final inventory discrepancy report	1	0.1	1	14	14	90.0	91	1274	18%	\$27.53	\$385	\$2.75	\$38.54	1000%
10) NCIMS-A prints master inventory listing	1	0.1	1	14	14	90.0	91	1274	18%	\$27.53	\$385	\$2.75	\$38.54	1000%
<b>Totals</b>	<b>8.25</b>	<b>24.1</b>		<b>140</b>	<b>462</b>		<b>493</b>	<b>9674</b>		<b>\$202.31</b>	<b>\$6,644</b>	<b>\$349.39</b>	<b>\$31,399</b>	

\* Sub-processes that will be eliminated with RFID/UID implementation are 2, 3, 4 and 8.

10 Year Total      **\$66,440**      **\$313,989**

ROI is negative, indicating an opportunity for IT enhancement.

ROK (Total K / Total M) = 21%  
ROI ((Total M - Total K) / Total M) = -79%

### “To Be” Inventory Knowledge Value Added Analysis at NSW Crane

Steps	Estimated Learning Time (ALT) (hrs.)	Work Time (hrs.)	Number of Employees	Number of times task completed (Annual)	Sum of task completion (Annual)	Knowledge Amount Embedded in IT (%)	Amount of Knowledge Units (per task)	Total Amount of Knowledge Units (Annual)	% Total Knowledge	Market Comparable Revenue	Total Market Comparable Revenue (Annual)	Process Cost	Total Process Cost (Annual)	ROK
	A	B	C	D	E = A*C*D	F	G = (A*C)+F	H = E*G	I = G/TotalG	J	K = E*J	L = B*J	M = E*L	N = J/L
1) NCIMS-A prints inventory worksheets by location	1.75	0.25	1	52	91	90.0	91.75	8349.25	16%	\$27.53	\$2,505	\$6.88	\$626	400%
2) Clerk conducts inventory of items with handheld device and data is transmitted wirelessly to NCIMS	0.625	2	2	52	65	95.0	96.25	6256.25	17%	\$16.50	\$1,073	\$33.00	\$2,145	50%
3) NCIMS-A run exception report of missing items	1.75	0.15	1	52	91	90.0	91.75	8349.25	16%	\$27.53	\$2,505	\$4.13	\$376	667%
4) Clerk conducts recount with handheld device and data is transmitted wirelessly to NCIMS	0.625	2.5	2	52	65	95.0	96.25	6256.25	17%	\$8.25	\$536	\$20.63	\$1,341	40%
5) NCIMS-A prints final inventory discrepancy report	1.75	0.1	1	52	91	90.0	91.75	8349.25	16%	\$27.53	\$2,505	\$2.75	\$251	1000%
6) NCIMS-A prints master inventory listing	1.75	0.1	1	52	91	90.0	91.75	8349.25	16%	\$27.53	\$2,505	\$2.75	\$251	1000%
<b>Totals</b>	<b>8.25</b>	<b>5.1</b>		<b>312</b>	<b>494</b>		<b>559.5</b>	<b>45909.5</b>		<b>\$134.87</b>	<b>\$11,630</b>	<b>\$70.14</b>	<b>\$4,989</b>	

10 Year Total      **\$116,297**      **\$49,888**

ROI and ROK significantly improved by IT.

ROK (Total K / Total M) = 233%  
ROI ((Total M - Total K) / Total M) = 133%



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USD (AT&L), DPAP, DD/PDI  
3060 Defense Pentagon, 5D325C  
Washington, DC 20301-3060

For further information, please contact  
the IUID Help Desk:  
Phone: (703) 848-7314  
Email: [info@uniqueid.org](mailto:info@uniqueid.org)